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Utilizing the FRBR Framework in Designing User-Focused Digital Content and Access Systems

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Abstract
This paper discusses the rapidly expanding environment of emerging electronic content and the importance of librarians to partner with new research and teaching communities in meeting users' needs to find, identify, select, and obtain the information and resources they need. The methodology and framework of the International Federation of Library Associations and Institutions' Functional Requirements for Bibliographic Records could serve as a useful tool in building expanded access and content systems.

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This paper discusses the rapidly expanding environment of emerging electronic content and the importance of librarians to partner with new research and teaching communities in meeting users' needs to find, identify, select, and obtain the information and resources they need. The methodology and framework of the International Federation of Library Associations and Institutions' Functional Requirements for Bibliographic Records could serve as a useful tool in building expanded access and content systems.

In today's information world, whether planned or not, mature library Web sites are used as fully fledged electronic libraries. Most major academic library Web sites offer a substantial array of library services (such as reference, interlibrary loan, reserve services, instructional tutorials, and circulation), with extensive electronic collections. Increasingly, they provide direct links to numerous external discovery tools and services, which often result in confusion for their users who, once they enter, can easily become lost as they navigate outside the walls of our electronic internal infrastructures. At one point, they may be navigating online catalogs and, with single nuanced clicks, they find themselves in remote content sites, such as Project Muse or Science Direct, with no clear way to return. As they migrate from one electronic area to another, they unknowingly may leave the comfort zones of authority control for the vast, undisciplined data content world of the Internet. Moreover, within library sites, jargon-laden library terminology used for headers and placement of services and information can be confusing and misleading as users try to guess where they need to go. Librarians need to be strong knowledge managers, with clear understanding of user approaches and needs, as libraries maintain, extend, and create pathways across their disorganized information environments.

This paper looks to this broadening nature of library information services and bibliographic access, and how the International Federation of Library Associations and Institutions' (IFLA) Functional Requirements for Bibliographic Records (FRBR) might offer a framework to analyze user needs for current and emerging discovery tools and their interoperability.[1] The rapidly changing bibliographic and information environment is discussed first, with a brief scan of four emerging discovery tools (portals, digital image management systems, institutional repositories, and instructional or learning management systems) that increasingly do or could coexist with holdings catalogs, and whose accessibility to content would benefit from user-focused systems and metadata-supporting

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frameworks. To understand the strengths of the FRBR analytical framework and its potential application, this paper then describes the FRBR development process and standards for bibliographic control.

Emerging Discovery Tools

For libraries to retain their trusted place in today's information environment, it is imperative that users believe that their libraries are the first places to go for reliable vetted information and research assistance. Libraries today, with their digital or electronic libraries, are used more than they ever have been—primarily due to the impressive growth of electronic reference tools and journals. However, the architectures we have designed are problematic to our future success. We must build and manage stronger, redesigned discovery systems that support straightforward access and delivery systems combined with services and instruction. The online catalog, while still a central library discovery tool, is residing (often unconnected) with other powerful discovery tools, including other-focused catalogs or databases for such resources as government documents, maps, and course reserves; serials management tools, such as Serials Solutions; powerful commercial access systems with direct links to full-text content; digital finding aids for manuscript collections; digital image databases and management and delivery systems; federated searching systems or portals; and rich new gateways to external digital libraries. Adding to this complex array are tools that reside in a broader academic context (including instructional management systems [IMS], geographic information systems, research databases, institutional repositories, extension-based content and information systems, and so on) and in the larger context of the Internet, with its increasing competitive mega search engines and sophisticated commercial book sellers.

One immediate challenge is that many key library users simply do not know what is held by libraries in their digital collections. This is most problematic with electronic journal literature, given its primary role within the academic research community and its budgetary costs. Serial budgets often represent 65 to 85 percent of academic library acquisitions budgets. Pathways provided for serial access often imitate the old print world, but the allure and transformation of the digital environment have changed expectations and breadth of choice. The Association for Research Libraries (ARL) 2003 LibQual+ survey data for participating ARL libraries found that the most telling difference between expectations and reality is that faculty and graduate students generally do not believe that their libraries have the journal literature they need.[2] This is true, in part, because of the devastating effects of major journal cancellation projects over the past decade and the inability of overextended budgets to accommodate new journal purchases. Perhaps the greatest difficultly for users, however, is actually finding what their libraries own. Very few unrelated access systems talk with each other. Imagine the different access pathways we expect library users to operate when they want to find citations to particular articles, browse back issues of specific journals, find the new journals or access tools for their disciplines, or do literature searches across markedly different disciplines when no single indexes or publishers adequately provide necessary coverage as well as when the scholarship of interest appears in published and unpublished conference proceedings and when their libraries do not subscribe to the journals that they need for specific articles. Quite simply, more holistic and federated approaches toward journal access are needed.

The array and complexity of new emerging digital objects and how we describe, access, and obtain them represent new challenges within bibliographic systems—particularly as they deal with content usually not included in traditional holdings catalogs. There now are new content providers, both new internal library partners (such as special collections librarians, map librarians, reserve staff, and instruction librarians) and new external partners (such as teaching and research faculty, extension colleagues, museums curators, archivists, and other libraries). Layered onto this environment of additional complex management and discovery tools (whether integrated or stand alone) is the need to provide efficient new access pathways to their content and, if possible, provide compatibility and interoperability among the new and traditional systems. Following are brief discussions of four emerging discovery tools that could have strong potential or existing benefits as partnered content systems with holdings catalogs. They could benefit also from stronger access systems using metadata and greater interoperability within electronic libraries and information management systems.

Portals

Portals have many different definitions because they have a wide variety of residences and purposes. This paper uses a relatively simple definition for a library portal: a discovery tool that provides broadcast or federated searching capabilities via a single metasearch across multiple information resources, with the potential of full-text retrieval or delivery through such mechanisms as fax, e-mail, and so on. Within this portal environment, Z39.50 and simple (but rarely elegant) screen-scraping technologies are typically employed to yield search results. For those libraries employing federated searching systems, current technologies and partnership matrixes are clearly limiting fully developed visions of multiple search strategies. Portals usually reside outside of online catalogs and have abilities

to vary the designated resources to be searched according to personal interests. As such, they emphasize user needs and have great potential to facilitate interdisciplinary research and learning.

Accessed content might represent public domain or commercially produced resources (e.g., indexing and abstracting or full-text resources or both) and, increasingly, a broad range of locally created tools and resources (e.g., online catalogs, unique born-digital or digitized full-text materials, special collections finding aids, electronic theses, reformatted audio-visual materials, and instructional learning objects). Portals can be expanded to include gateways to other library services, such as reference and interlibrary loan services, for assisting users in selecting and obtaining content. Portals may also provide links to and integration with campus-based learning management systems as well as a broad array of university-based resources and services.

Usually a portal's basic search covers a select group of general resources, such as the online catalog, OCLC's WorldCat, and broad-based core indexing, abstracting, and content resources, such as Gale's Expanded Academic ASAP, Ebsco Host, JSTOR, Project Muse, and Elsevier's Science Direct. The number of searchable resources is largely dictated by affordable unlimited user licenses. For more specialized subject areas, focused federated searches are often constructed. For example, a business-focused search might include ten to twenty additional resources. The attractiveness of portals rests with combining the online catalog, with its greatest strength in its monographic access, and indexing and abstracting databases, with their greatest strengths at article-level access. This harkens back to when catalogs included in-analytics for individual works. Last and most importantly, portals often bring actual journal content to users' desktops. Their current drawbacks and difficulties stem from lack of standards within citation systems and display when screen scraping is used, and minimal cooperation with the commercial content industry. Moreover, navigating around portal-based resources can be very confusing—however, library users who are used to the haphazardness of the Web, particularly young undergraduates, may not care.

Portals can profoundly change the roles of holdings catalogs, indexing and abstracting tools, and library management systems. For local planning, management, and ongoing assessment, involving a wide range of librarians and staff who are focused on the needs of users and use their feedback as they make decisions on where the portal resides, is essential. Questions to be considered include where and how one enters the portal; how is it searched—is it explicitly found, or does it exist as a behind-the-scenes tool; what databases it searches; what the display designs are; and what are the relationships to other library management systems, including the holdings catalog, and, if present, the university portal, is.

Digital Image Management and Delivery Systems

Large numbers of image or visual digital collections are now being created, many within a growing number of national and international digitization projects. The resulting objects, whether born digital or reformatted from print, come from a broad array of disciplines and interests. All repositories (whether found in libraries, museums, galleries, or private collections) face the same challenge of how to create long-lasting, high-quality images that can be managed, accessed, searched and retrieved, and preserved through a variety of methods. These issues are highlighted, given the interest in creating preservation-level copies as well as lower-grade access versions for the public. How and if these complex collections are accessed through public holdings catalogs or other gateways represent serious planning issues. Furthermore, interest in creating necessary links between images of any given artist's creative work and the conventional printed works (found in book and journal collections) about that artist is growing.

Companies such as LUNA Imaging offer sophisticated software systems that support building and managing these complex databases, complete with metadata cataloging systems. This new environment calls for new partners to create access pathways for users who are interested in the actual creative work and the academic discourse about the work. As a result, joint planners face making complex decisions regarding the advisability of a stand-alone catalog as well as integrating that catalog or database within a library portal or bringing new metadata into the holdings catalog.

Institutional Repositories

Institutional repositories represent a new and exciting shift in the research landscape of accessible scholarship. This shift recognizes a new role for universities in managing, accessing, promoting, and preserving institutional scholarly assets. The concept of institutional repositories is, however, gaining traction slowly on academic campuses. In some campuses, the exploration centers on focused disciplinary-based efforts; in other campuses, the initiatives are broader-based. Lynch defines university-based institutional repositories as "a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members," that require "an organizational commitment to the stewardship of these digital materials."[3] He goes on to call for the collaboration of librarians, information technologists, archives and records managers, faculty and university administrators, and policy makers to collaborate in the

creation of such repositories, which would include approving the necessary policies, building the digital architectures, identifying content, and creating the necessary access and preservation systems.

Early attention on institutional repositories has been based largely on the initial successes of and publicity surrounding the Massachusetts Institute of Technology's DSPACE, a digital repository system created in collaboration with Hewlett Packard.[4] DSPACE is designed to capture, store, index, preserve, and redistribute an organization's research material in digital formats. As new implementers use DSPACE or other systems, it is becoming clear that the possibilities of potential content contained in institutional repositories are endless. As a result, the types of owners and the various roles for libraries and academic computing centers within this arena of scholarship are equally endless.

Examples of unpublished content might include:

- unpublished research on particular topics (e.g., plant sciences, polio, ethics in cultural heritage, ground water quality);
- series of local symposium or conference papers (e.g., annual symposiums on Shakespeare, icebergs, nanotechnologies);
- extension materials (e.g., research on equine leg fractures, small business revitalization efforts, impact of radiated food on health);
- oral histories (e.g., remembrances and experiences of women engineers, civil rights leaders, Native American entrepreneurs, Gulf War veterans); and
- recorded campus student or faculty musical performances or student theater productions.

Major challenges in developing institutional repositories involve building access frameworks for the content, which includes determining metadata standards and appropriate access systems (such as an online catalog, a portal, a separate database, resolving rights management issues) and deciding on the necessary preservation infrastructure. Furthermore, through new partnerships, the needs, perspectives, and concerns of the content creators and expected audiences are coupled with the experience librarians have and the creative roles they may play in creating these new resource systems.

Learning Management Systems

In May 2004, McLean and Lynch issued an influential joint white paper on behalf of the IMS Global Learning Consortium and the Coalition for Networked Information titled "Interoperability between Library Information Services and Learning Environments—Bridging the Gaps."[5] In their paper, they called for greater partnerships between libraries and their academic partners in expanding the academic support, content, and expertise that libraries can provide in building learning management systems. They made a strong case that libraries should not only want to incorporate collections of learning objects into their distributed information environments, but also should identify unfamiliar metadata and attributes and look for new searching interfaces based upon these new attributes. In particular, they advocated that libraries should be:

- examining the relationship to individual reserve articles associated with a specific courses;
- ensuring that digital rights, copyright, and fair-use are properly managed;
- providing reference component services; and
- creating single authorization systems.

The following roles also should be considered for public service and technical service librarians:

- working with academic instructors in identifying key resources that might be of use to students in course assignments or background readings;
- providing increased library instruction through course-related instruction;
- enriching the learning or instructional module with online tutorials on information literacy and plagiarism;
- taking advantage of how best to capitalize on rich resources, such as the holdings catalog, full-text databases, indexing and abstracting tools, and other pertinent discovery tools; and
- creating metadata for instructional learning objects that could support searching across local instructional or learning management systems.

Partnering and Tools

Today's electronic environment library environment is providing access to an enormous array of commercially produced electronic collections and is beginning to extend electronic access to pivotal unique library collections that have been hidden largely from public view. Moreover, libraries are becoming partners in providing access to a large new array of university and public research and learning materials. As mentioned earlier, librarians must be seen as highly relevant knowledge managers and facilitators, and libraries as the first place where people come to for quality information and trusted content.

With all of these expansions to digital content, the definitions for professional and staff positions are evolving as they create and maintain new knowledge systems. Positions such as metadata managers, electronic acquisitions librarians, and

digital curators or content specialists are increasingly common. Knowledge management teams with floating memberships of catalogers or metadata specialists; subject librarians responsible for reference, collection development, and instruction; technical staff for digital and Web-based applications; researchers and teachers; and faculty and student content creators are necessary. Such teams might systematically realign and redefine the vetted local bibliographic universe with its disparate discovery systems through the use of intertwined metadata (bibliographic, technical, and subject) to access a broad range of content that, as mentioned earlier, is increasingly unique and local. These partnership projects require tools that support access systems of structured and unstructured content of all formats. Their needs reflect what gave rise to the initial international IFLA study known as FRBR, whose methodology and foundation could serve as a useful tool for building these new systems and facilitate their interoperability.

FRBR Background

The IFLA study on FRBR has exerted strong influence on international bibliographic control standards and theory since its publication in 1998.[6] The original study, commissioned in 1992 by the Standing Committee of the IFLA Section on Cataloguing, was designed to address international interests in reducing escalating costs of cataloging and to create a user-focused framework of standards for bibliographic control. The study group employed a framework for developing neutral bibliographic standards in such areas as structure and design of international bibliographic databases, cooperative cataloging project guidelines, bibliographic descriptive or metadata standards for electronic media and other new materials, and new collocation operating functions for searching and display within online bibliographic and full-text online systems. The work culminated in a set of core functional requirements for bibliographic records for all formats and media, and it reasserted the goals for structured bibliographic access in a complex and transforming electronic environment.

With today's focus on new and rapidly evolving discovery tools for exploding amounts of digital content, the original study's goals and framework are more relevant than ever. Stepping back ten years, imagining the capabilities of our current environment would have been difficult; however, it was clear then how quickly the electronic information landscape was changing.

FRBR Entity-Relationship Framework

The FRBR study used the entity-relationship analytical framework, which was based on Chen's 1979 entity-relationship model, to explore the functions of the bibliographic record through the identification of core bibliographic entities and their associated attributes.[7] Based on this analysis, the study proposed a basic functionality for national bibliographic records.

Since its publication, the interest in FRBR has been broad and international in scope. It has influenced and continues to influence the revisions and evolution of many standards, including IFLA's several International Standards for Bibliographic Descriptions, basic cataloging requirements for national bibliographic agencies, the Dublin Core Initiative, and the Anglo-American Cataloguing Rules. Numerous conferences have been held on FRBR (initially held in Europe and, more recently, at a 2004 American Library Association preconference held by the Cataloging and Classfication Section). The study's conclusions and framework have been the research topic for an ever-increasing number of articles and discussions. A simple search on Google yields thousands of citations and Web sites on the topic of FRBR (including extensive links on the IFLA Web site).[8] FRBR has been incorporated into the curriculum of a number of library and information graduate programs throughout the world, and one now hears of catalogs and databases being "FRBRized." Within the metadata and systems industries, several organizations are actively pursuing new discovery tools and library management systems that FRBRize search results through innovative collocation displays recognizing the FRBR entities with their corresponding attributes and relationships. Most noted of these are OCLC's Fiction Finder (which, in addition to its records for print editions, includes more than seventy thousand records for audio recordings), RLG's (Research Library Group) search engine RedLightGreen, and VTLS's (Visionary Technology in Library Solutions) Virtua (its integrated library system).[9]

The FRBR record functions (i.e., to find, identify, select, and obtain) have clear antecedents in the objectives of the catalog espoused by Charles Cutter in his 1876 objectives and by Seymour Lubetzky as he influenced IFLA's 1961 Paris Principles.[10] In particular, Cutter's interest in the catalog serving the "convenience of the public" is evident in the finding and collocating functions of the FRBR user-focus framework.[11] The study defines a powerful conceptual model represented by three groups of entities. The most recognized group contains the work, expression, manifestation, and item. The other two groups represent the entities responsible for intellectual or artistic custodianship and subjects. With its use of the entity-relationship modeling technique and its focus upon the needs and interests of the user, FRBR provides a framework to evaluate and define metadata content and structure provisional displays of bibliographic entities with their relationships. Beyond its framework, its emerging strength resides in how it defines bibliographic relationships and how they

could be portrayed through powerful collocation displays of numerous expressions of different works. Just consider how one might coherently display all the different versions of Shakespeare's play *King Lear,* including various manuscripts, published editions, Braille versions, translations, movie versions, and cartoon versions, as well as works based on *King Lear,* such as Jane Smiley's *A Thousand Acres*.

FRBR's framework and its modeling technique provide a proven and useful method for analyzing discovery tools, their interoperability, and growing usability complexities and for suggesting display standards that promote design mechanisms to support collocation. The need for a neutral framework for analyzing and creating discovery tools is increasingly apparent as we face the growing call to establish standards, within libraries and within consortial and cooperative environments, to address such areas as:

- structures and design of cataloging project guidelines;
- metadata standards for specific projects; and
- new collocation operating functions for searching and display within emerging information systems that can envelop online catalogs with other local and commercial discovery tools.

Conclusion

The expertise and perspectives of librarians building collections and access systems, along with instructional and research support systems, are increasingly valuable in building the next generation of information and content systems that users want to use. In repositioning traditional bibliographic records and catalogs within our expanding environments, the FRBR framework can help facilitate and influence the development of the new discovery tools and their metadata creation within local and cooperative environments. FRBR's enduring strength is its neutrality as to bibliographic conventions and its theoretical approach that focuses on the user, the object, and function—all of which has enabled its timelessness to application.

References and Notes

1. International Federation of Library Associations and Institutions, Study Group on the Functional Requirements for Bibliographic Record, *Functional Requirements for Bibliographic Records: Final Report*, UBCIM Publications—New Series, vol. 19 (München: K. G. Saur, 1998). Accessed Aug. 19, 2005, www.ifla.org/VII/s13/frbr/frbr.htm.
2. Sixty-six ARL member libraries collectively surveyed more than 13,8000 faculty and graduate students in the 2003 LibQUAL+ survey. Among the twenty-five survey questions, the question pertaining to "access to print and/or electronic journal collections I require for me work" showed the greatest gap between desired and perceived levels of service, for faculty and graduate students. For faculty, the gap (on a nine-point Likert rating scale) was 0.5; for graduate students, 0.22. See Colleen Cook, *LibQUAL+ Spring 2003 Survey: Group Results, ARL* (Washington, D.C.: Association of Research Libraries/Texas A & M Univ., 2003), 111, 122.
3. Clifford A. Lynch, "Institutional Repositories: Essential Infrastructure for Scholarship in the Digital Age," *ARL Bimonthly Report* no. 226 (Feb. 2003), 2.
4. Massachusetts Institute of Technology Libraries, DSPACE. Accessed June 12, 2005, http://dspace.org/index.html.
5. Neil McLean and Clifford A. Lynch, "Interoperatibility Between Library Information Services and Learning Environments—Bridging the Gaps: A Joint White Paper on behalf of the IMS Global Learning Consortium and the Coalition for Networked Information: May 10, 2004." Accessed May 25, 2005, www.imsglobal.org/digitalrepositories/CNIandIMS_ 2004.pdf
6. IFLA Study Group on the Functional Requirements for Bibliographic Records, *Functional Requirements for Bibliographic Records*.
7. Peter Pin-Shan Chen, "The Entity-Relationship Model: Towards a Unified View of Data," *ACM Transactions on Database Systems* 1, no. 1 (1979): 9–36.
8. International Federation of Library Association and Institutions, IFLANET. Accessed Aug. 19, 2005, www.ifla.org.
9. OCLC Online Computer Library Center, *A FRBR-Based Prototype for Fiction in WorldCat OCLC Fiction Finder*. Accessed June 10, 2005, www.oclc.org/research/projects/frbr/fictionfinder.htm; RLG (Research Libraries Group), Redlightgreen. Accessed June 10, 2005, www.rlg.org/en/page.php?Page_ID=435 and www.redlightgreen.com; VTLS (Visionary Technology in Library Solutions), *Functional Requirements for Bibliographic Records (FRBR) Presentations.* Accessed June 10, 2005, www.vtls.com/Corporate/FRBR.shtml.
10. International Conference on Cataloguing Principles, *Report: International Conference on Cataloguing Principles, Paris, 9th–18th October 1961* (London: Organizing Committee of the International Conference on Cataloguing Principles, 1963).
11. Charles A. Cutter, *Rules for a Dictionary Catalog*, 4th ed., rewritten (Washington, D.C.: Government Printing Office, 1904), 6.